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辽宁北票晚侏罗世鲟类一新科*

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本文所记述的鱼化石是1964年"五一"节前夕辽宁煤炭管理局潘广工程师送交我们鉴定的。在鉴定过程中，又收到南京地质古生物研究所东北中生代地层队陈丕基同志寄来的一批标本，依据标籤记载，其中有一部分是与上述那部分标本采自同一地点；在同一层位中还有狼鳍鱼(*Lycoptera*)化石。关于这一含鱼化石地层的地层划分问题，上述各调查采集人已分别给予详细论述[1,2]。本文仅就鱼化石部分加以记述和探讨。

标 本 記 述

鲟 目 Acipenseroidei

北票鲟科 Peipiaosteidae 新科

北票鲟属 *Peipiaosteus* 新属

属型种：潘氏北票鲟 *P. pani*, gen. et sp. nov.

特征：体小呈梭形，头略低平，吻圆钝，顎上无牙齿。额骨及顶骨均发育。鳃盖骨小，下鳃盖骨大，具有鳃条骨。体几裸露，仅有一列小的侧线鳞。尾全歪型，裸露无鳞。

潘氏北票鲟 *Peipiaosteus pani*, gen. et sp. nov.

(插图1—3；图版I—IV)

正型标本：一近于完整的个体，只是尾鳍末端稍有缺失。古脊椎动物与古人类研究所标本登记号：V. 3049.1

标本：全部标本共计40余块，除上述正型标本外，其余多系不完整的头部、躯干和尾部。标本登记号：V. 3049.2-38

特征：同属的特征。

产地和时代：辽宁北票县南岭炒米甸子尖山子沟。晚侏罗世。

标本描述：大多数标本显露着头部的腹面，骨骼保存的较为清晰；从侧面和背面保存的则很少，且保存也较差。

头略宽而低平，吻短而圆钝。在V.3049.3号标本上可观察到额骨、顶骨、后额骨、膜质翼耳骨和后颞骨。额骨略呈椭圆形，长大于宽，左右两者以锯齿状边缘嵌接，后部稍稍分开，形成空隙。额骨后内侧缘与顶骨邻接；其后外侧缘与膜质翼耳骨邻接。顶骨略呈长

* 1965年5月29日收到。
1) 潘 广：辽西区东部中生代地层(未刊稿)。
2) 地质古生物研究所东北中生代地层队：东北中生代的一些地层问题(未刊稿)。

方形，左右两者相接的骨缝呈直线状，其前部也略有分开的空隙，因此在颅顶区中央，顶骨前缘与额骨后缘之间有一个小的似菱形的空隙。但由于标本表面盖着一薄层岩石，不易修理，观察不甚清楚，因而此一空隙的确切范围与大小尚不确定。在顶骨的外侧有膜质翼耳骨，其形状与顶骨近似，但较之略长，与顶骨接缝呈直线状。在膜质翼耳骨的前外侧有一略呈圆形的骨片，是后额骨 (postfrontal)，以左侧的保存较完整。上述各骨片的表面中央区略凸拱，由该处有向边缘辐射的细纹(插图 1；图版 II, 2)。

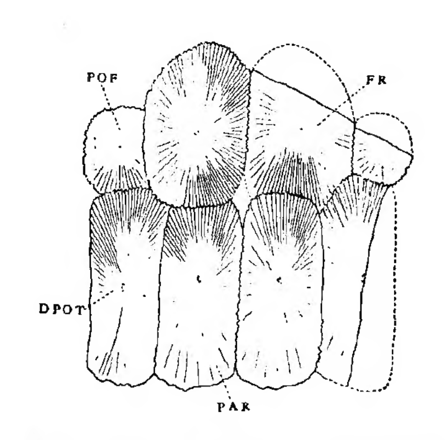


插图 1　潘氏北票鲟 (*Peipiaosteus pani*, gen. et sp. nov.) 的部分颅顶骨，顶视，×2。DPOT. 膜质翼耳骨，FR. 额骨，PAR. 顶骨，PF. 后额骨。

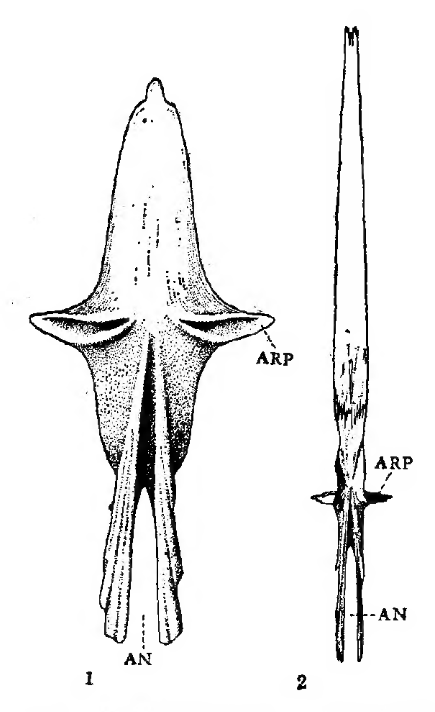


插图 2　鲟类副蝶骨的腹面视　1. 潘氏北票鲟 (*Peipiaosteus pani*, gen. et sp. nov.). ×2；2. 匙吻鲟 (*Polyodon spathula* Walb.), ×2/9. AN. 动脉凹槽，ARP. 升枝。

在左膜质翼耳骨后侧方还保存有一长形的骨片，是后颞骨 (posttemporal)。

在大多数标本上都可观察到副蝶骨；另有一块与头骨分离的副蝶骨保存较好 (图版 II, 3)。该骨宽大而扁平，在骨片中心区略增厚而展宽，并由此向两侧伸出一突伸枝，称为升枝(ascending ramus)，如以左右升枝联线为界将副蝶骨分成前后两部分，则前部较后部略短。前部大致呈宽舌状，表面平滑，边缘薄；后部稍窄，后端分开呈叉状，叉的空隙处称为动脉凹槽 (aortic notch)。两支的表面有纵行脊纹，相当明显。升枝的基部与副蝶骨主体相夹处看不到什么凹沟(插图 2)。由副蝶骨的形状与前后部的长短比例来说，与 *Chondrosteus* 的有些类似；其升枝向侧方平直伸出的情况也与匙吻鲟 (*Polyodon*) 的近似，但后者的副蝶骨特别伸长，相当特化。在前后部的长度比例上有了很大的不同(插图 2)。

在副蝶骨的前方有一对略呈半圆形的大骨片，是翼骨 (pterygoid)，它们几占据了整个吻部，其内缘和后缘形成弧形边缘，且增厚，自弧的中点有向前缘和侧缘放射出的细纹(图版 II, 1)。

在翼骨的前侧方保存着上颚骨和齿骨，两者形状大体相似，均为稍弯曲的长形骨片，后部略宽，前部向中间靠拢，形成颚弧。在其上未观察到牙齿。在 V. 3049.1 号标本上可

见到舌颚骨 (hyomandibular)，呈扁棒状，两端稍膨大，以上端更大一些。角舌骨的形状与之略似，但较小。在一些标本上还可观察到鳃弓和鳃耙，鳃耙密集排列(图版 II, 1)。

鳃盖系统　在大多数标本上保存有下鳃盖骨，只在 V.3049.1 号标本上保存有鳃盖骨。鳃盖骨很小，略呈椭圆形，位于下鳃盖骨的前上方。下鳃盖骨大，略呈圆片状，其前上角稍突伸，前下缘平直，稍向内凹入，后缘及下缘呈弧形。下鳃盖骨表面有显明的同心圆纹及放射纹，其边缘稍有波状刻(图版 I, 1; II, 4)。在同一标本上，下鳃盖骨的前下方保存有 7 根鳃条骨 (branchiostegal ray)，为密集排列的窄条状骨片，前端略有曲屈。

由于缺少呈现头骨侧面的标本，故鳃盖前方的一些骨骼观察不到。眼的位置由在标本上的印痕判断，居于口裂的上方，不太靠前。从鳃盖系统的情况看，与软骨硬鳞科的 *Chondrosteus* 这一属的近似。

肩带　在正型标本上可观察到匙骨，后匙骨，上匙骨和锁骨。匙骨较硕壮，下部宽大而略向前方弯曲。后匙骨略小，呈直棒状骨片。在其上方有一略长方形骨片，是上匙骨(图版 I, 1)。在匙骨下方有一略呈三角形的骨板，较厚，保存的较好，是锁骨(clavicle，图版 IV, 1)。

胸鳍　胸鳍大，最外的鳍条不加粗，也不分叉，其他鳍条在近端开始分节，节距很长，节长为其宽的 5 至 6 倍；鳍条在远端 1/4 处开始分叉。鳍条数目达 40 余根，展开略呈扇形(图版 II, 1; IV, 1)。

腹鳍　腹鳍位于体中部，距吻端与尾尖约等距。鳍基较长，左右鳍基的距离自前端向后逐渐变窄 (图版 II, 1)。在 V. 3049.14 号标本上可观察到一列短的支持骨，约计 7 根。鳍条细而密，共计 30 余根，其分节分叉情况与胸鳍的相同，伸展开呈三角形。

背鳍　背鳍小，无棘鳞，位于身体的中点以后，其起点居腹鳍起点之后，约与腹鳍终点相对。鳍条共计 32 根，各鳍条自近端开始分节，节距长，远端开始分叉。背鳍展开略呈等边三角形。在 V. 3049.1 号标本上保存有 9 根支持骨，为长条形骨片。

臀鳍　臀鳍较背鳍略大，且形状相似，其起点与背鳍基的中点相对，鳍基较背鳍基长，在 V. 3049.14 号标本上可观察到支持骨 11 根，为窄条状，两端稍宽扁的骨片。臀鳍条共达 32 根，每根自近端开始分节，节距长，远端开始分叉。

尾鳍　虽在正型标本上缺失尾鳍末端，但由另两块标本所保存的完整尾鳍，可知具有全歪型尾鳍；上叶特别伸长，背缘无棘鳞，亦无有其他鲟所具有的鳞片，而是完全裸露；尾鳍下叶发达，有约达 80 余根长的鳍条，除近尾柄的数根短小外，第 5 根最长，自此根向后逆次变短变细，这样使尾鳍下叶不呈叉裂状，而成一个三角旗形(图版 I, 3; III, 3)。尾鳍条自基部开始分节，节距长；在远端 1/3 处分叉。在 V. 3049.23 号标本上保存有 16—17 根支持骨 (图版 III, 3)。这种上叶完全裸露无鳞的尾型，在鲟类中是很特别的。它与 *Chondrosteus* 的尾型不同，也与鲟和匙吻鲟的尾型不同，后两者的下叶鳍条因长短变化而呈现出程度不一的叉裂尾型。

鳞片　这种鱼只在体侧有一列小的侧线鳞，其他部分均裸露无鳞。有三块标本上保存着这种鳞片，它为长方形小板片，沿着长轴凹陷成一纵沟，在前后两端形成凹刻，当为感觉管的开口。此种鳞片自头后开始向后平行体轴伸达尾柄，排列均匀，数目约达 85 个之多(图版 IV; 3—4)。

另在 V.3049.37 号标本上,在肩带部位观察到一些分散的小齿突 (denticle),其形状是前端圆钝,后端有三个指状突,以中间的一个较长大,整个形状象一山字形笔架状(插图3)。这类齿突也曾见之于匙吻鲟科 (Polyodontidae) 的古白鲟 (*Paleopsephurus*) 和现生种中 (MacAlpin, 1947), 也存于鲟科 (Acipenseridae) 中,但其形状均有不同。我们标本上的齿突形状与匙吻鲟科的现生属种,如白鲟和匙吻鲟的有些相似。

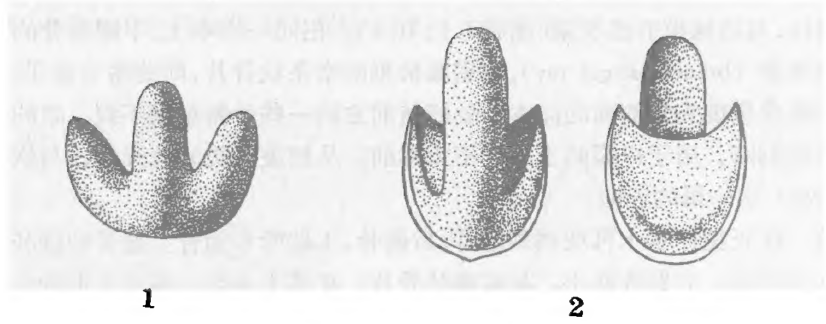


插图3 肩带区齿突的形状
1.潘氏北票鲟 (*Peipiaosteus pani*, gen. et sp. nov.),外视,×60。
2.扬子江白鲟 (*Psephurus gladius* Mart.) 外视(左)与内视(右),(张有为供稿), ×30。

又在 V.3049.28 号标本上可以观察到关于脊柱和附属部分,由岩石上保存的黝黑色痕迹,表示神经棘、血管棘,神经弧和血管弧的存在位置,后两者之间的空隙处, 是椎体的位置;由前向后联贯起来而成的一长条空白处,表示了脊柱的位置,但它们全未骨化,只留下印痕和空白地位(图版 III, 2)。

比较和讨论: 以上所描述的标本,在体形和头部骨片的形状及彼此位置关系上,虽与 *Chondrosteus acipenseroides* 有些相似,但各骨片的形状和大小上又有所不同,尤其是北票标本在体侧有一列小的侧线鳞,尾部裸露无鳞的特征,很容易与前者区分。鳍条分节情况和齿突的形状与白鲟的有些相近。但白鲟的吻部伸长;头盖骨片骨化减退,空隙增加; 尾鳍上叶有特殊形状的棘鳞等特征与北票标本显然不同。更由于鲟科属种的体部有五列菱形骨板,也与北票标本易于区分。笔者认为北票标本代表鲟类的一新类型,今订名为潘氏北票鲟 (*Peipiaosteus pani*, gen. et sp. nov.),种名赠与标本采集人之一潘广工程师。

由北票鲟 (*Peipiaosteus*) 的特征表明它应归属于鲟目是无疑的,但与已知科比较,有很明显的差别,难于列入任何已知科中,笔者建议另成立一新科——北票鲟科 (Peipiaosteidae)。

另外需要在这里提及的是芮斯 (Reis, 1909) 在记述西伯利亚外贝加尔地区的鱼化石时,曾描述过一块不完整的标本,是躯干的一段,保存有腹鳍、胸鳍、背鳍和部分臀鳍。被订名为 *Stichopterus woodwardi* Reis。同时他将 Rohon (1890) 所订的 *Opsigonus gracilis* 也归并入到他这一属里,而改名为 *S. gracilis* (Rohon)。但由于外贝加尔的标本保存的不全,芮斯当时对 *Stichopterus* 属的特征记述的不多,仅提到了鳍的位置与鳍条的数目,由鳍条数目看显然与北票鲟的不同; 又我们标本上更主要的尾鳍特征,也无法与之比较。不过有一点是值得注意的,就是 *Stichopterus* 也有狼鳍鱼与之共生。因此笔者认为目前根据芮斯所记述的少而不详的特征虽难于做具体比较,但由这一迹象至少可以表

明当时生存的鲟类可能不只是一种，今后还可有发现。

北票鲟的系统位置是一非常有趣的问题，由表 1 所列的特征比较中可看出它与鲟目的已知科均有区别。北票鲟除了与早侏罗世的 *Chondrosteus* 有些相似点外，而沒有象现今还有现生代表的鲟科和匙吻鲟科所具有的那些特化特征。北票鲟的尾型，长的腹鳍基都是原始性的征状，头部骨骼形状又与 *Chondrosteus* 的较为接近，所以笔者认为北票鲟代表着一个与软骨硬鳞科较接近的分支；它与匙吻鲟科的关系可能要远一些，尽管在齿突的形状上有些相似。它们的系统关系可能如插图 4 所示。

表 1　北票鳞科与鳞目中已知科的部分結构比較表

(Table 1: Comparison of the structures of Peipiaosteidae and other families of Acipenseroidei)

结　构 Structures	北票鲟科 Peipiaosteidae	软骨硬鳞科 Chondrosteidae	鲟　科 Acipenseridae	匙吻鲟科 Polyodontidae
吻　部 Snout	不伸长 not protruded	不伸长 not protruded	伸　长 protruded	伸　长 protruded
颚上牙齿 Dentition on jaws	无 teeth absent	无 teeth absent	无 teeth absent	有(幼时) present (young ind.)
鰓盖骨 Operculum	有 present	有 present	无 absent	无 absent
体部鳞列 Squmation on trunk region	有侧线鳞 lateral-line scale present	裸　露 naked	有 5 行菱形骨板 5 series of keeled bony plates	退化或缺少 rudimentary or absent
腹鳍位置 Situation of ventral fins	位于背鳍之前 anterior to the dorsal	与背鳍相对 opposite to the dorsal	位于背鳍之前 anterior to the dorsal	稍位于背鳍之前 slightly anterior to the dorsal
尾鳍形状 Caudal fin	长歪尾 elongate heterocercal	歪尾、下叶有凹切 heterocercal, notched on lower lobe	歪尾、下叶有凹切 heterocercal, notched on lower lobe	歪尾、下叶有凹切 heterocercal, notched on lower lobe
尾鳍棘鳞和鳞片 Dorsal caudal fulcra and caudal scales	无 absent	有 present	有 present	有 present
肩带区的小齿突 Small denticles on shoulder girdle	有 present	不　明 unknown	有 present	有 present

由北票鲟的头稍低平，身体不十分侧扁，表明它适应靠近水底活动。宽大的口裂，颚上沒有牙齿，相当发育的鳃耙等特征，推测该种鱼主要靠过滤水中的微体生物来摄食，较小的体型，体部和尾鳍又缺少坚硬的骨板鳞和棘鳞之类的保护物，它可能更适应在较平静的水域中生活，如广阔的湖水中。

生存时代： 由北票鲟的一些特征与早侏罗世的属种（*Chondrosteus*）多所相似，而沒有什么象白垩纪后期一些类型的特化特征，如伸长的吻部与成列的骨板、尾鳍上的大棘鳞等。就以有现生代表的鲟科和匙吻鲟科属种在地史上的记录来看，最早见之于晚白垩世地层中，例如 MacAlpin 氏所记述的古白鲟(晚白垩世)，其吻部伸长的程度与现代白鲟的已很近似，头盖骨片间的空隙已很明显了，说明目前存在于匙吻鲟科中的一些特征早存在

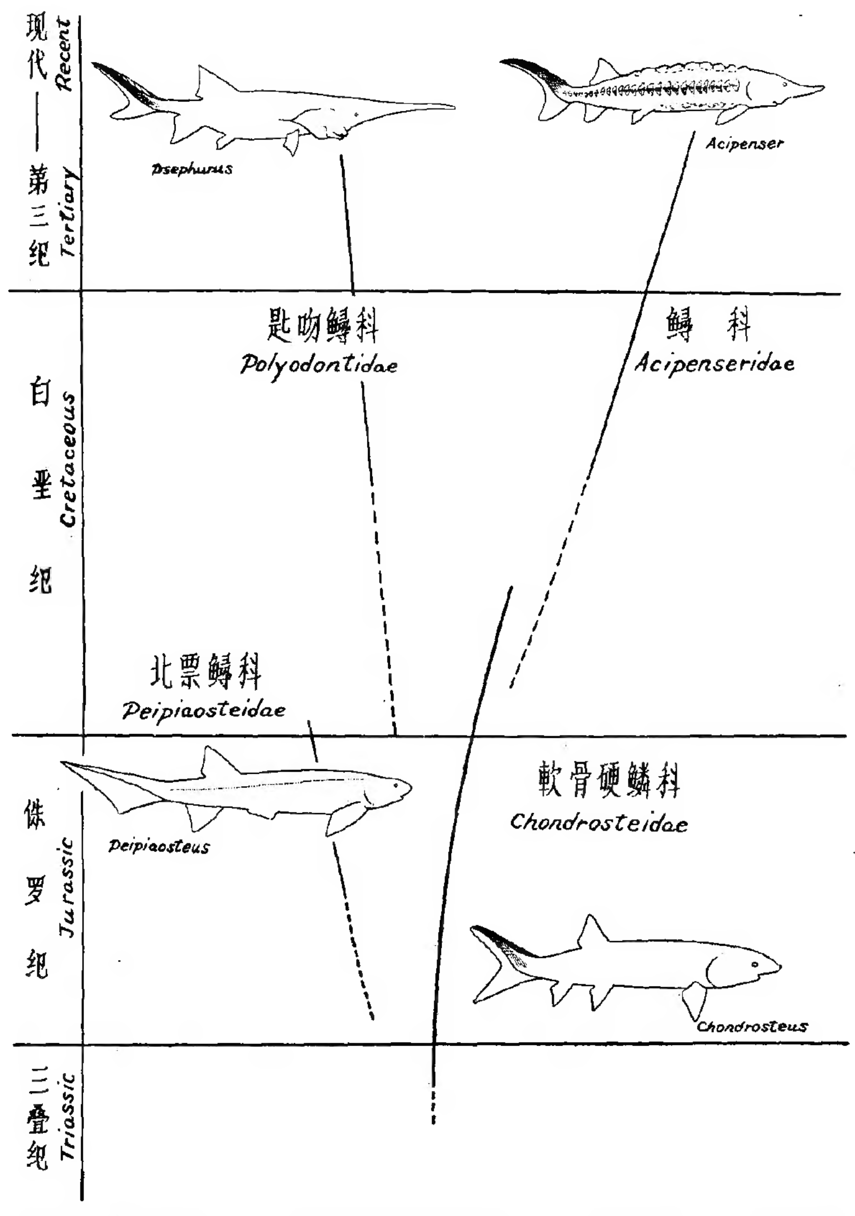


插图 4 鲟类的系统关系想象图 (A hypothetical phylogeny of the Acipenseroid Fishes)

于白垩纪的代表中。以北票鲟的特征不是象后期种类那么特化，而与 *Chondrosteus* 较相似的性质来说，其生存时代不可能太晚，而应为晚侏罗世。再者，与北票鲟共生的狼鳍鱼是晚侏罗世在东亚分布很广的原始真骨鱼类(刘宪亭等，1963)。此外，在我国陕甘和内蒙一带，以及山东等地与狼鳍鱼共生的还有中华弓鳍鱼 (*Sinamia*)，也是属于弓鳍鱼类 (Amioidea) 中较原始的类型(刘东生等，1963)。这三类鱼组成了当时该地区鱼羣。

目前在冀北辽西一带的同一地层里虽还未发现中华弓鳍鱼化石，可能是由于它们所喜栖居的环境有些不同所致；由保存中华弓鳍鱼的岩性偏粗来看，也说明了这一点。可以这样认为，上述三类鱼都是生活于河川湖泊中的鱼类，而中华弓鳍鱼则可能更喜在较流动

的水中活动。这是化石埋藏的情况反映了生物与生活环境关系的一个例证。

就目前在华北地区这套地层中所知的鱼化石而言，已代表着三大类鱼，即软骨硬鳞类（如北票鲟）、全骨类（如中华弓鳍鱼）和真骨鱼类（如狼鳍鱼）。在生存时代上，前两类出现的相当早，到侏罗纪以后则走向衰落途径，只有极少数存留下来，分布地区有了缩小；真骨鱼类出现较晚，自侏罗纪兴起后，发展辐射的很快，继而取代了前两类鱼的地位，至白垩纪则相当繁多了。从华北地区所发现的北票鲟、中华弓鳍鱼和狼鳍鱼各自的系统位置分析，这是一很有代表性的鱼群，具体反映了古老的与新兴的分子交替情况，它具有侏罗纪晚期鱼群成员的特色。对这三类鱼化石的研究为了解鲟类、弓鳍鱼类和真骨鱼类的发展史提供了关键性的资料。

就以鲟类来说，在我国境内现尚生存的有鲟、鳇（*Huso*）和白鲟，它们分别归属于鲟科和匙吻鲟科。关于鲟类化石，我国过去只在第四系中发现过鲟的鳞板，今在辽西发现的北票鲟，还是第一次发现如此完好的该类鱼化石标本，结合我国目前尚有不少种现生种鲟生存的情况，推测自侏罗纪以来，在华北地区就有鲟类生存繁衍下来，一直到现在。相信将来在侏罗纪及其后的地层中还会发现该类鱼化石。本文虽就目前资料提出一个鲟类系统关系设想图来，其中有些环节也还有待新的材料来证实，但已显示出我国这一地区、这一地层中的材料在探讨鲟类的起源与发展方面的重要性，从而提供了新的线索。

最后，笔者对辽宁煤炭管理局潘广、常征路等同志，南京地质古生物研究所东北中生代地层队全体同志，在野外采集标本付出辛勤劳动，并将标本赠与我们研究，表示感谢。在研究过程中蒙朱元鼎先生给予宝贵启示，动物研究所脊椎动物分类室同志们的帮助，并承周明镇、刘东生先生给文稿提出修改意见和修改文稿，王哲夫先生摄影，胡惠清同志绘图，在此一并致以谢意。

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A NEW STURGEON FROM THE UPPER JURASSIC OF LIAONING, NORTH CHINA

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The specimens of the new acipenseroid dealt with in this paper were collected at Peipiao in western Liaoning by the field teams of the Bureau of Coal Industry of Liaoning and the Institute of Geology and Paleontology, Academia Sinica. All the specimens, about 40 individuals in total, were from the same locality and horizon, and occurred in association with *Lycoptera,* a well-known primitive teleost in the east of Asia. No other kind of fishes has yet been collected in this district. The discovery of an acipenseroid from this horizon is very important not only in paleichthyology, but also in stratigraphy. It would throw a new light on the problem of the geological age of the fossil-bearing strata in this district.

The specimens were embadded in a grayish shale and preserved mostly in dorsoventral position. Only one specimen is in lateral aspect, but its head portion is lacking.

The stratigraphy of the fossiliferous deposits will be given separately by the collectors. The present paper gives a description of the fish remains only.

DESCRIPTION OF SPECIMENS

Order Acipenseroidei

Family Peipiaosteidae, new family

Genus *Peipiaosteus*, new genus

Genotypic species: *Peipiaosteus pani*, gen. et sp. nov.

Diagnosis: Fish of small size, body fusiform. Head slightly depressed and moderate in size; rostral obtuse; jaws toothless. Scales absent except along the lateral lines. Caudal long-heterocercal and naked. Fulcra absent. Frontal and parietal developed. Opercular very small, subopercular large; branchiostegal rays present. Dorsal slightly remote. External bones feebly coated with ganoine.

Peipiaosteus pani, gen. et sp. nov.

(Figs. 1—3; Plates I—IV)

Holotype: A nearly complete fish, only the tip of caudal fin lacking. Cat. No. V.3049.1 of IVPP.

Paratypes: The specimens figured and photographed in this paper.

Diagnosis: The same as for the genus.

Materials: This species is represented by about forty pieces of specimens, among which ten pieces are of head portion, and the others are trunk and caudal portions. From these specimens a complete outline of the new acipenseroid can be obtained.

Horizon and Locality: Upper Jurassic. Tsien-shan-tze-kou, Nanling, Peipiao, Liaoning province.

Description: The head of a small acipenseroid fish to its total length is estimated to be 1 to 5.5 in proportion; and its depth to its length to be 1 to 6.5.

Head is moderate in size, with a slightly broad and depressed appearance. The top view of the skull is shown in the specimen No. V.3049.3. In this piece of specimen are shown the parietals, the dermopterotics, the frontals and the postfrontals (fig. 1). The parietals are oblong, measuring about 21 mm in length and by 11 mm in breadth. They articulate with each other on the median line by suture. The dermopterotics are slightly longer, measuring about 23 mm in length and by 8 mm in breadth. They articulate at the inner margins with the parietals. The frontals are elliptic in shape, measuring about 22 mm in length and by 15 mm in breadth, and articulate with each other and posteriorly with the parietals and dermopterotics. There is no other bone interlocated between both parietals and frontals. The postfrontals are similar to frontals in shape, but smaller, measuring about 13 mm in length and by 9 mm in breadth. They articulate at the inner margins with the frontals, and posteriorly with dermopterotics.

The centre of each of the above-mentioned bony plates is slightly elevated and with some fine line radiating outwards to the periphery. All of these plates are interlocked by means of interfingering suture. In the median line there is a small space between the parietals and frontals. The space is nearly long diamond-shaped and its exact outline is not clear owning to the presence of matrix. On the postero-right corner of the specimen, there is a long bony plate, the posttemporal.

The general structure of the mouth in our specimen resembles closely that in *Chondrosteus* and is not similar to that in recent sturgeon. Both maxillary and dentary are slender rod-like plates. They are slightly expanded at hind portion and with anterior portion bending inwards to the median line. The snout is rounded and not pointed. There is no trace of teeth on both maxillary and dentary. The outline of the other bones, such as the hyomandibulars, the ceratohyals, the pterygoids, the parasphenoid, and gill-rakers can be traced.

The hyomandibular is a strong rod-like plate resembling that of *Chondrosteus.* It is well ossified and widened at the upper end. There is a ridge along the shaft of this bone. The ceratohyals are rod-like, flattened and broadened at the extremities. Traces of gill-bars are preserved in several specimens.

The parasphenoid bone, a large bony plate is well preserved in several specimens. Through the centre of ossification it may be divided into two divisions, the anterior one is a flat tongue-shaped plate which expands anteriorly and laterally and with a thin border and smooth surface, but not forming a spear point. The posterior division, which includes the portion with the centre of ossification, is thicker and stronger than other parts of the bone, forming a transverse plane and sending out ascending rami in the form of strong laterally directed splints. The ascending rami are somewhat similar to those in *Polyodon.* The lateral edge of each ramus is strengthened by the presence of nearly parallel ridges. There is no clear notch at the base of ramus as found in *Paleopsephurus.* The posterior division narrows gradually behind the median transverse plane, and its posterior termination is deeply notched. The posterior division was divided by this notch into two rami, which projected backwards to the junction of trunk of the head.

There is a pair of pterygoids situated on each side of the termination of the parasphenoid. The pterygoid is a semi-circular shaped bony plate. Its ossification centre is situated on the inner arched margin, and from it several radiating lines run towards the antero-lateral margin of this plate. This pair of large pterygoids is very conspicuous, occupying a large space of the snout portion of head.

Although the opercular bone is shown in several specimens, but only in one specimen (V.3049.1) it is clear and complete. The operculum is a small round plate, situated at the anterior upper corner of the suboperculum. The suboperculum is a broad, flat plate and almost circular at the posterior border. It has no distinct articulating facet, only an extending bar on the upper anterior margin. Below this bar the anterior border is slightly concave. The surface of both of the opercular and subopercular bones is ornamented with radial and circular lines. Branchiostegal rays are present, about seven are preserved in specimen V.3049.1. No trace of preoperculum could be found in our specimens.

Pectoral girdle and fins: Four elements of pectoral girdle were preserved in the specimen V.3049.1. The cleithrum is a strong and robust spoon-like bone, which bends anteriorly and becomes broader at the lower half. Beneath this bone is the large, nearly triangular plate, the clavicle. This is the largest bone of the pectoral girdle. The post-cleithrum is small and rod-like splint resting just upon cleithrum. The supra-cleithrum is roughly oval-shaped plate, its ossification centre lies at the middle point and close to its outer margin.

The pectoral fins are large and nearly triangular in shape when expanded. The outer fin-ray is not very robust in comparison with the others. All of the rays are jointed at the proximate end. Each joint has a length about 5—6 times large than its breadth; and bifurcated near the distal portion. The pectoral consists of more than forty rays.

The ventral fins are situated at the median point between the tip of the snout and the tail. The ventral base is moderate in length, the interval between the fins is rather broader and becomes narrower backwards gradually (Pl. II, 1). The ventral fin consists of about thirty fin-rays, which are jointed and branched as those of the pectorals. We have found a series of fin-supports in the specimen V.3049.14. They are styliform ossicles and about seven in number.

The dorsal fin is rather small, and situated on the hind portion of the body. Its origin is behind that of ventrals, nearly opposite to the space between the ventrals and the anal. It consists of about thirty two rays, which are jointed near the base and branched extremely. About nine fin-supports are seen in the specimen V.3049.1. They are short styliform ossicles (Pl. I, 1 and III, 1).

The anal fin is similar in size to the dorsal, and situated nearer to the base of caudal fin than to the ventral fins. Its origin is opposite to the mid-point of the base of dorsal. The dorsal contains thirty two rays, jointed and branched as those of dorsal. About eleven fin-supports are seen in specimen V.3049.14.

The caudal fin is more curious in appearance among the acipenseroids. It is a long heterocercal tail. No trace of scales and fulcra has yet been found in the present specimens. The upper border of the fin is naked, without any scales or scutes. The lower lobe is considerably developed and consists of about eighty fin-rays. In the specimen V.3049.23 about 16—17 styliform interhaemal ossicles could be seen. The anterior four of the fin-rays are short, and the fifth the longest. From the sixth on they decrease in

length successively to the furthest extremity of the caudal fin. These fin-rays are jointed at the base and bifurcated distally.

Vertebral column and squamation: In the specimen V.3049.28 we can see the outline of vertebral column, which remained as blemish on the matrix. The notochord is persistent, and its sheath is not ossified. The neural arches and spines, the haemal arches and spines are well shown, but also not ossified (Pl. III, 2).

The body of this fish is naked, only with small scales retained along the lateral lines. These scales are very small and longitudinally grooved by lateral line pore which nearly separate it into an upper and a lower halves (Pl. IV, 4). These scales form a continuous line from the scapular region to the caudal pedicle, and are not less than eighty five in number. Scales of this kind have never been seen in both fossils and recent forms of acipenseroids. In Polyodontidae, there are lateral line tubes embedded in the skin, but no trace of scales existed externally.

In addition to this kind of scales, there are small denticles lying over the entire scapular arch region. Each denticle consists of two portions, the anterior and the posterior. The posterior part consists of three finger-like projections. These projections are nearly similar in shape and size, only the middle one is slightly longer. They combind basally to form a round end, the anterior portion. This kind of denticles is of interest and has been described by MacAlpin in his article on *Paleosephurus*. The shape of the denticle of *Paleosephurus* is peculiar, unlike that in our specimen. A comparison of denticles taken from the scapular arch region of *Psephurus* and the present specimen are shown in figure 3.

Comparison and Discussion

The species described above resembles *Chondrosteus* in the arrangement of head bones, pectoral girdle and naked body; but they differ in detail. Moreover, the presence of lateral line scales and the naked tail of our specimen can be readily distinguished from the genus mentioned. In view of the shape of denticle and fin-rays, our specimens also resemble those of *Polyodon*, but the naked elongate-heterocercal tail is very peculiar, which can be distinguished from the latter and other known acipenseroids. According to the essential characteristics mentioned above, the Peipiao specimen belongs distinctly to the Acipenseriformes, but represents a new form, to which the name *Peipiaosteus pani* (gen. et sp. nov.) is proposed. The specific name is coined in honour of Mr. P'an-kuang, geological engineer and one of the collectors.

The systematic position of *Peipiaosteus* is of great interest. According to the basic features mentioned above (see Table 1), it could not be included in the known families (Chondrosteidae, Acipenseridae and Polyodontidae). Therefore, the present writers propose to erect a new family—Peipiaosteidae. It is probably a stem form related to Chondrosteidae and flourished during Late Jurassic.

To date, three groups of fishes have been discovered in Upper Jurassic of North China, namely, Lycopteridae, Sinamiidae and Peipiaosteidae. The evidence from the present materials proves that they are fresh-water dwellers. The deficiency of defensive armour in *Peipiaosteus* indicates that they seemed to have habituated themselves in a calm environment.

图版說明 (EXPLANATION OF PLATES)

潘氏北票鱘 *Peipiaosteus pani*, gen. et sp. nov.

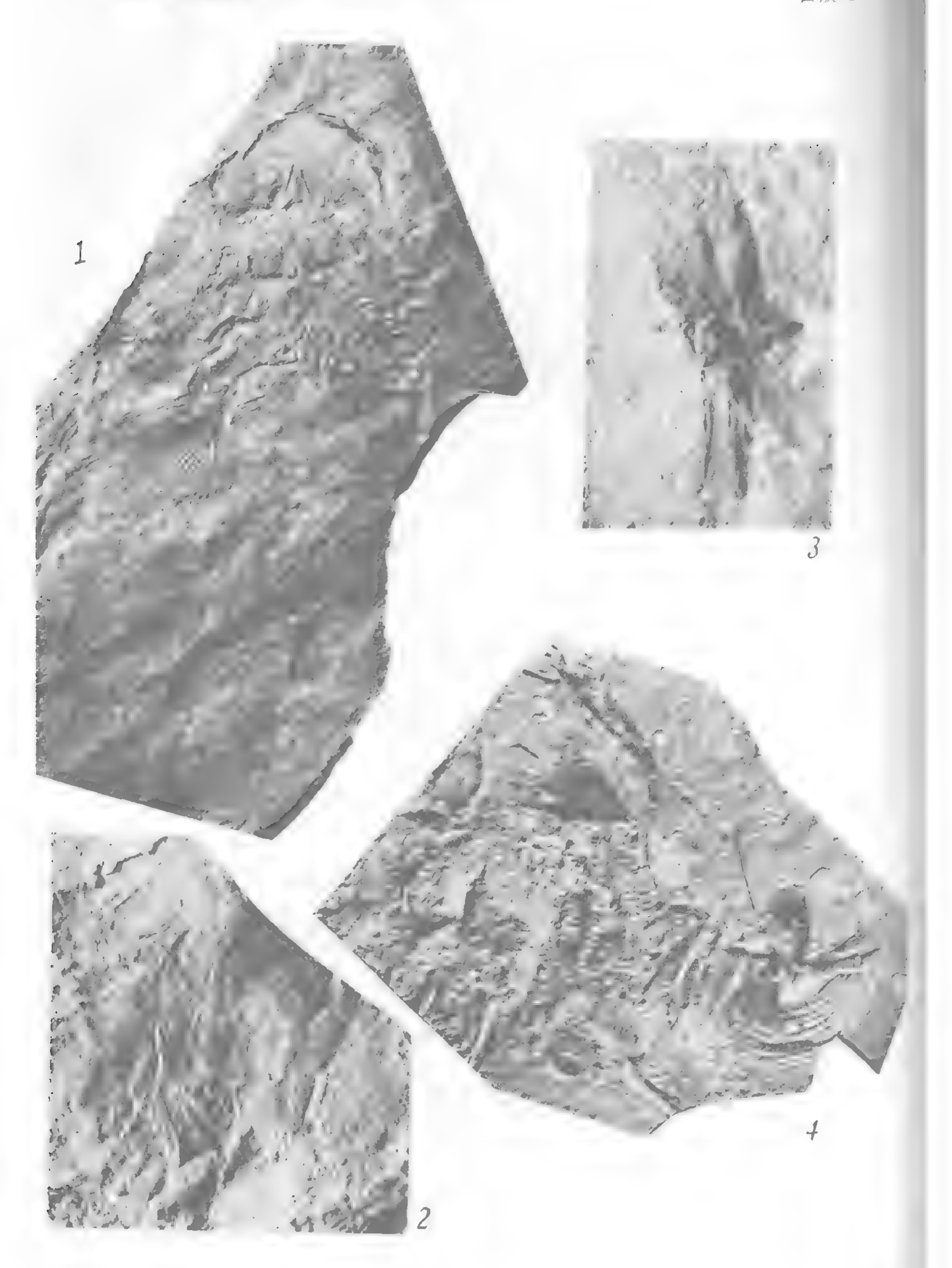
1. 正型标本,一近乎完整的个体。标本登记号: V. 3049.1, ×1
Holotype, a nearly complete individual. Cat. No. of IVPP. V. 3049.1

2. 躯干的中段,示背鳍和臀鳍的位置。V. 3049.31, ×1.7
A portion of trunk, indicating the position of dorsal and anal fins.

3. 躯干和保存完好的尾部。V. 3049.34, ×2
A portion of trunk with well preserved caudal fin.



图版 II



潘氏北票鲟 *Peipiaosteus pani*, gen. et sp. nov.

1. 头部和躯干的前段。V. 3049.5, ×2

Head and anterior portion of trunk.

2. 头骨的一部分,示额骨、顶骨等的形状及位置关系。 V. 3049.3, ×2

A portion of skull bones, indicating the shape of frontals, parietals ··· etc.

3. 一单独保存的副蝶骨。V. 3049.17, ×2.5

An isolated parasphenoid in dorsal view.

4. 部分头部骨片和鳃盖骨。V. 3049.11, ×1

Some skull bones and opercular bone.

潘氏北票鲟 *Peipiaosteus pani*, gen. et sp. nov.

1. 尾部,鳍的位置稍有错动。V. 3049.14, ×1

Caudal portion, the position of fins slightly displaced.

2. 躯干和尾部。V. 3049.28, ×1

The trunk and caudal portions, right side view.

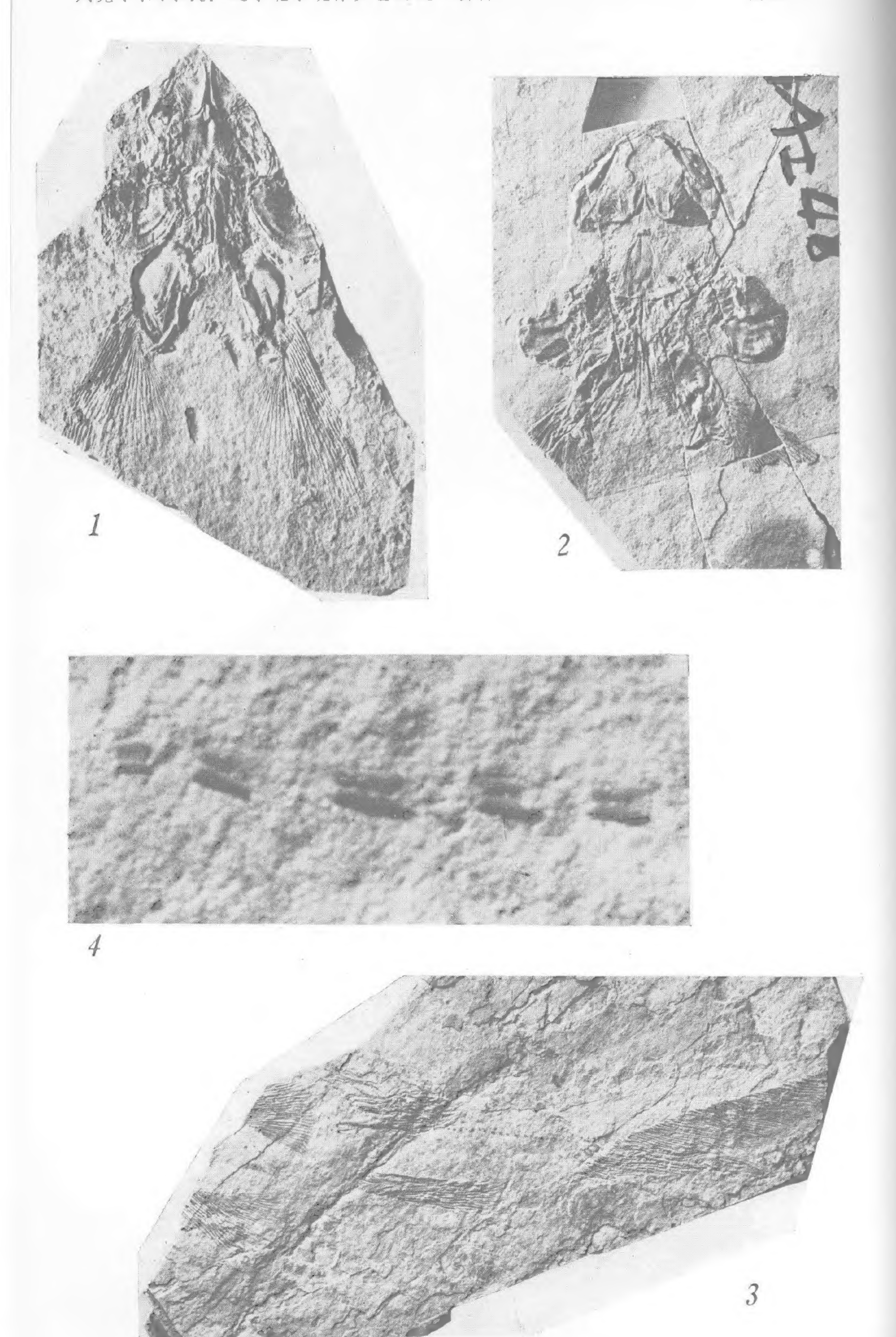
3. 尾鳍,示清楚的鳍条和支持骨,左侧视。V. 3049.23, ×1.5

Caudal fin, indicating the fin-supports and fin-rays.

1

2

3



潘氏北票鲟 *Peipiaosteus pani*, gen. et sp. nov.

1. 一不完整的头部。 V.3049.10, ×1

An incomplete head, ventral view.

2. 一不完整的头部。V. 3049.9, ×2

An incomplete head, ventral view.

3. 躯干的一段,示侧线鳞的位置。V. 3049.24, ×1

A part of trunk, showing the series of lateral line scales.

4. 同上,放大的侧线鳞。 ×16

Ditto, enlarged lateral line scales.